

CIRCUIT DIAGRAMS

Workshop: EL
02.1989

0151 En

G e n e r a l :

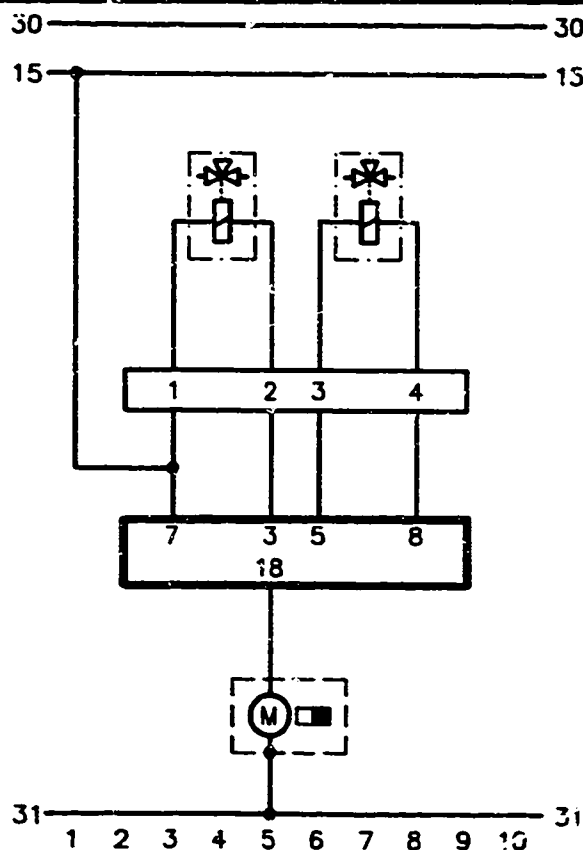
The increasing functional scope of and thus the increasing number of components in electronic systems have made it necessary to break down the system circuit diagram on our SIS Microcards into several partial circuit diagrams.

In order to achieve a clear-cut division of the overall system into partial diagrams, a change has been made from schematic diagrams to representation using circuit-diagram techniques.

Structure of circuit diagrams

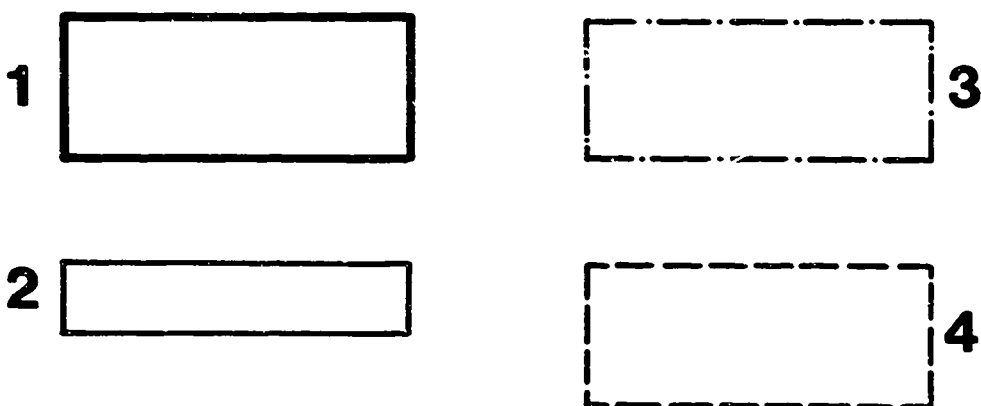
Bus bars, term. 30, term. 15 and term. 31 are shown as a solid line at the top or bottom. The components of the system are marked between the bus bars and connected with current paths from positive to negative. The individual current paths are given current-path numbers.

Circuit diagrams can be broken down into any number of partial diagrams. The current-path numbers make it possible to arrange the partial diagrams one after the other without problem and to provide a precise destination statement when making cross-references between the partial diagrams.



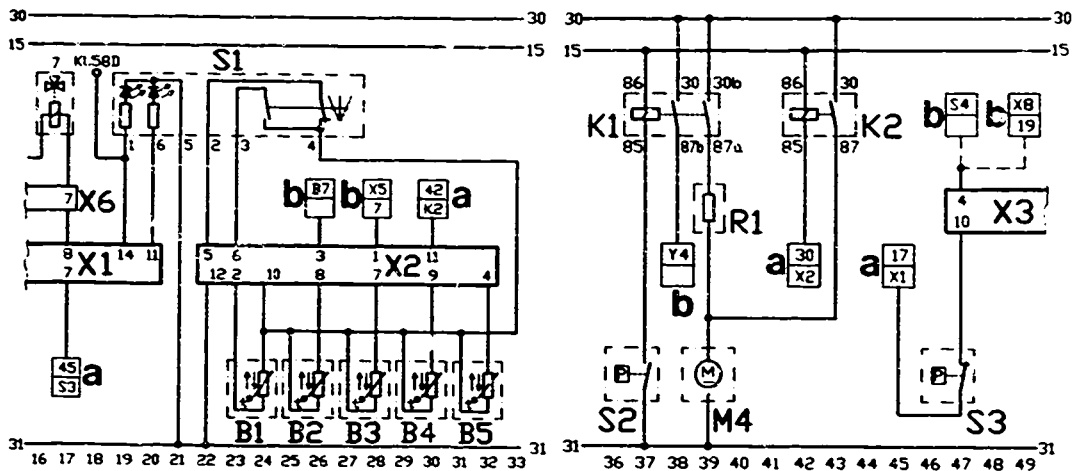
Presentation of components in circuit diagram

- 1 = Solid, thick border:
Control-unit plug
- 2 = Solid, thin border:
Plug connection in wiring harness
or component which is only represented by means of a symbol
- 3 = Border with dot-dash line:
Component with housing not connected to ground
- 4 = Border with dashed line:
Component with housing connected to ground



REFERENCING CURRENT PATHS IN THE CIRCUIT DIAGRAM

Branches to another current path or to a component not marked on this system circuit diagram are presented at the end of the current path in a reference box. These reference boxes consist of two fields. In the case of branches to another current path (item a) the address (current-path number) is given in the reference box in the upper field and the destination component in the lower field. In the event of branches to a component not marked on the system circuit diagram (item b), the destination component is indicated in the upper field and the component terminal in the lower field.



Marking of devices

A = Control unit, system, assembly
B = Converter from non-electrical to electrical quantities
C = Capacitor
D = Store (memory unit)
E = Load
F = Fuse
G = Generator
H = Watchdog, indicator
K = Relay
L = Inductance
M = Motor
N = Regulator/controller
P = Measuring instrument
R = Resistor
S = Switch

Marking of devices (continued)

T = Transformer
V = Semiconductor
W = Lead
X = Plug connection
Y = Electrically-actuated mechanical device
Z = Electrical filter, interference-suppression filter

Special features

If components are installed in the system as an option, then the leads are shown as dashed lines in the circuit diagram.

Advantages of circuit diagrams

- * Clear-cut presentation
- * Plug illustrations on last follow-up circuit diagram
- * All system variants on corresponding follow-up diagrams
- * Standard symbols
- * Uniform abbreviations for components

Published by:

Robert Bosch GmbH
Division KH
After-Sales-Service Department for
Training and Technology (KH/VSK)

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T-ALTERNATORS

Workshop: EL
01.1990
0206 En

Jack assignment

Depending on capacity rating,
T-alternators feature various
multi-pole sockets with different jack
assignment.

Given in the following is a list of
alternators with the corresponding
jack assignment and the original
designation of the mating plug.

The addresses of the manufacturers are
indicated at the end of the list.

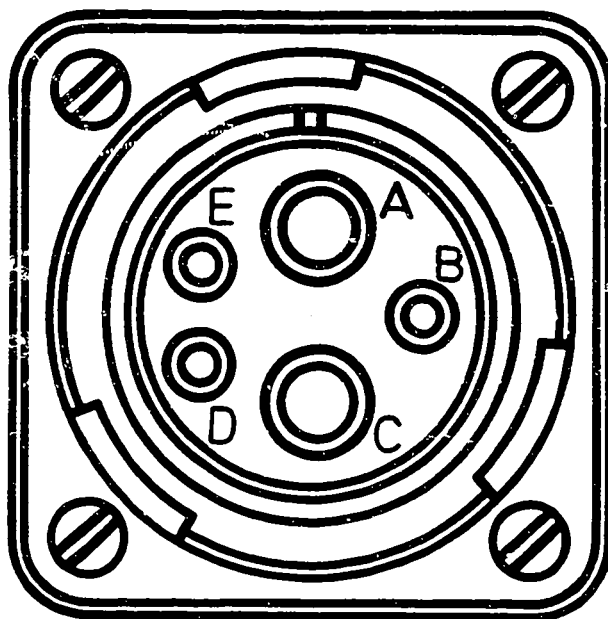
Alternator 0 120 600 571 T1-28V 60/89A
0 120 689 504 T1-28V 58/105A

Socket assignment:

A = D-
B = D+
C = B+
D = W
E = not used

Mating plug: Litton Co.
VG 95234 D-24-12 SN

Or for increased vibration stressing
CIR 06 F24-12S-CR



KME 00128

Alternator 0 120 600 572 T1-28V 60/89A

Socket assignment:

A = B+	F = Phase W
B = D-	G = Phase V
C = DF1	H = Jumper
D = DF2	J = Jumper
E = Phase U	

Mating plug:

Litton Co.
VG 95234 *-20A9-PN

(* = Housing shape D, E, G or H)

for B+ VG 95234

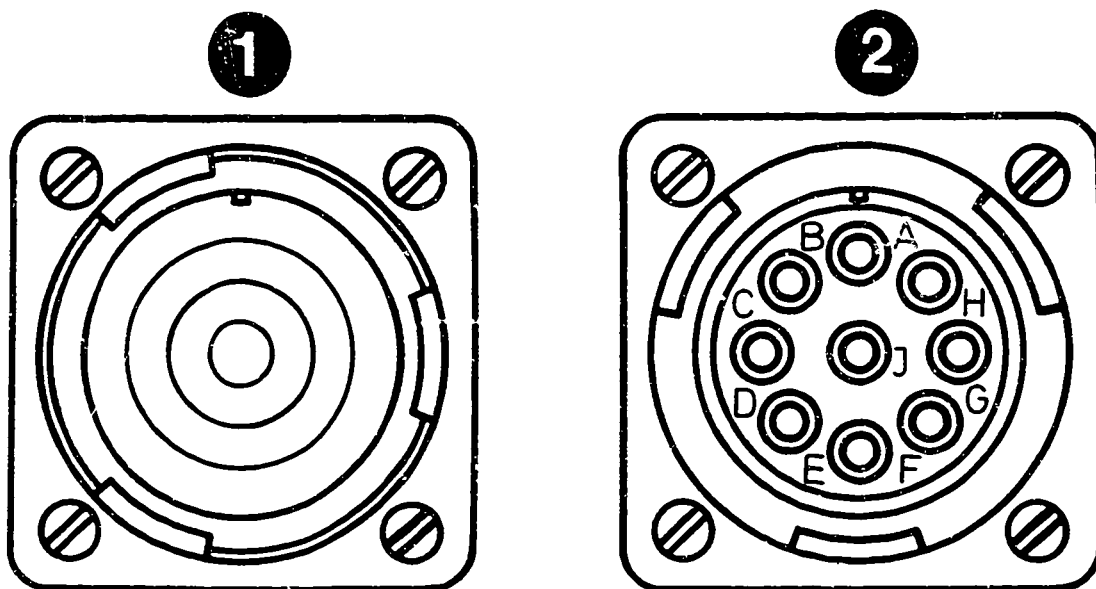
D, E, G or H-16-12-SN

for D- VG 95234

D, E, G or H-16-12-PN

1 = 1-pole socket for B+ and D-

2 = 9-pole socket



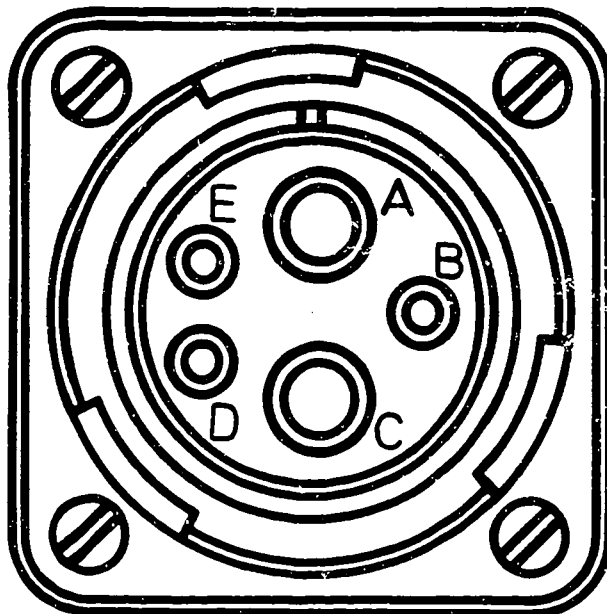
KME 00129

Alternator 0 120 600 574 T1-28V 60/89A

Socket assignment: A = D-
 B = D+
 C = B+
 D = D-
 E = DF

Mating plug: Litton Co.
 VG 95234
 D or E-24-12 SN

For increased vibration stressing
 CIR 06 F24-12 S-CR
 or
 CIR 08 F24-12 S-CR

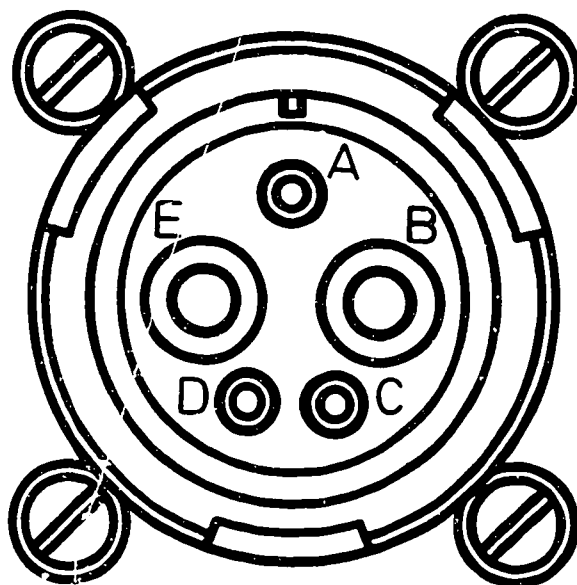


KME 00128

Alternator 0 120 600 577 T1-28V 33/139A

Socket assignment: A = D-
 B = D-
 C = DF
 D = D+
 E = B+

Mating plug: Litton Co.
 VG 95234
 D or H-32-1 SN



KME 00130

Alternator 0 120 600 589 T1- 84V 31A 15

Socket assignment:

5-pole
(left picture)

A = D-
B = -
C = B+
D = -
E = -

6-pole
(right picture)

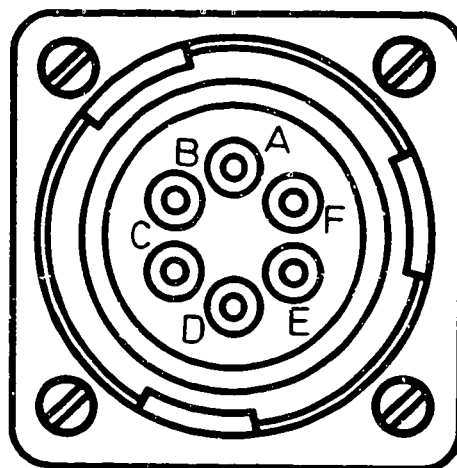
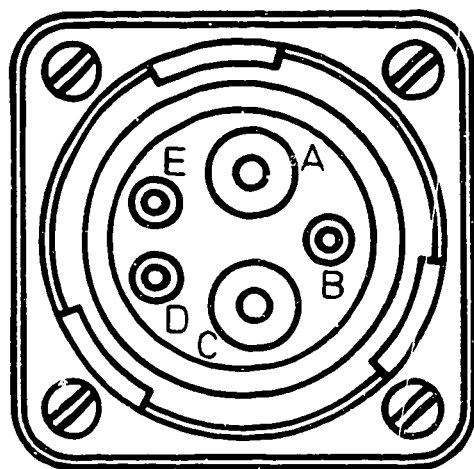
A = D+
B = D-
C = DF1
D = DF2
E = S
F = Ground

Mating plug:

Litton Co.

5-pole VG 95234 D-24-12 SN

6-pole VG 95234 D-14S-6 PN



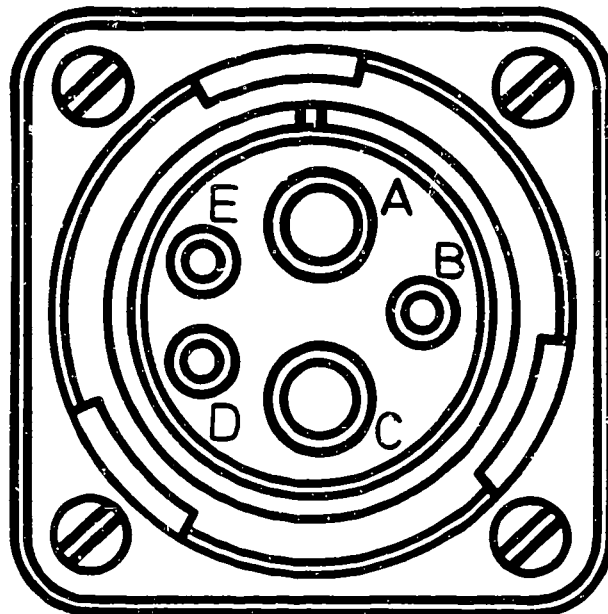
KME 00131

Alternator 0 120 689 504 T1-28V58/105 A
0 120 689 510 T1-28V58/105 A

Socket assignment: A = D- or ground
 B = D+
 C = B+
 D = W
 E = not used

Mating plug: Litton Co.
 VG95234 D-24-12SN

For increased vibration stressing
 CIR06 F24-12S-F80
or
 CIR08 F24-12S-CR

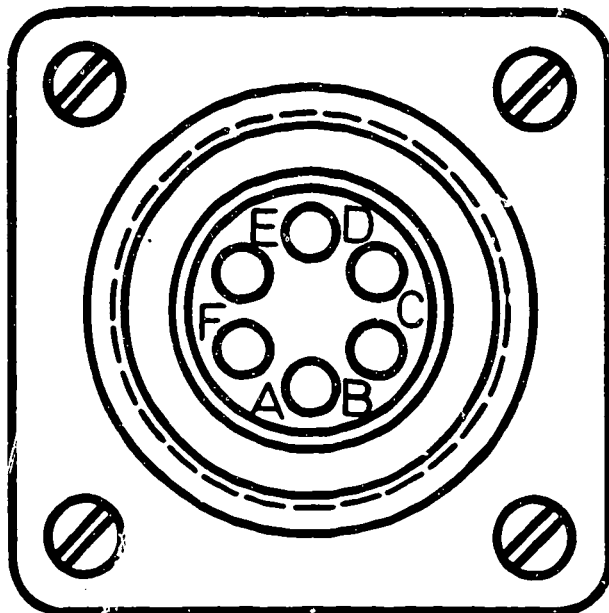


KME 00128

Alternator 0 121 600 502 T2-28V85A12
0 121 600 503 T2-28V85A12
0 121 600 505 T2-28V85A12
0 121 600 506 T2-28V85A12
0 121 600 507 T2-28V85A12
0 121 600 508 T2-28V85A12

Socket assignment: A = D+
B = D-
C = DF
D = -
E = -
F = B+

Mating plug: Cannon Co.
or Litton Co.
MS3106F14S-6P
or MS3108R14S-6P
(90 ° offset)

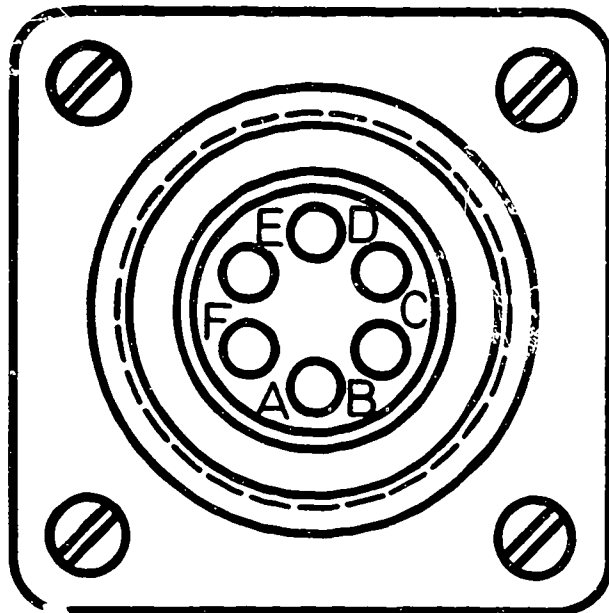


KME 00132

Alternator 0 121 600 509 T2-28V 82/103A

Socket assignment: A = D+
 B = D-
 C = DF
 D = D-
 E = D+
 F = B+

Mating plug: Cannon Co.
 or Litton Co.
 MS3106 F 14S-6P
 or MS3108 R 14S-6P
 (90 ° offset)

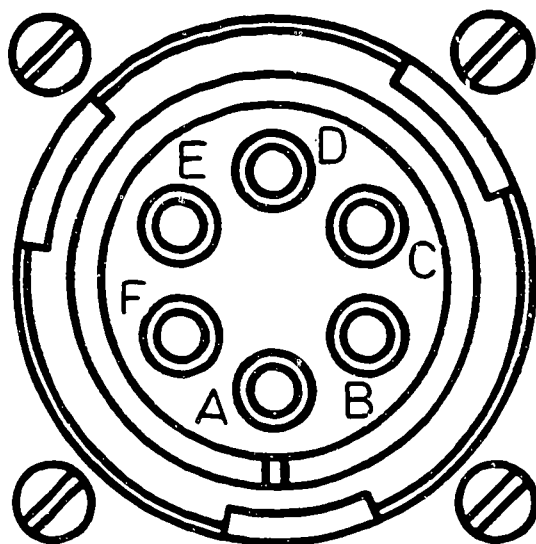


KME 00132

Alternator 0 121 600 516 T2-28V 82/103A

Socket assignment: A = D+
 B = D-
 C = DF1
 D = DF2
 E = D+
 F = B+

Mating plug: Cannon Co.
 or Litton Co.
 VG95234 D14S-6PN
 or VG95234 E14S-6PN
 (90 ° offset)

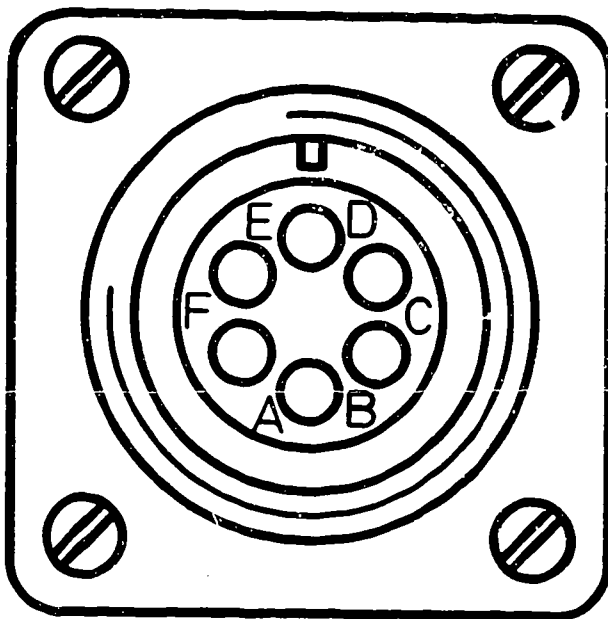


KME 00133

Alternator 0 121 600 513 T2-28V 82/103A

Socket assignment: A = D+
 B = D-
 C = DF
 D = D-
 E = D+
 F = B+

Mating plug: Cannon Co.
 or Litton Co.
 CA 06 EA 14S-6P
 MS3106 F 14S-6P
 or MS3108 R 14S-6P
 (90 ° offset)

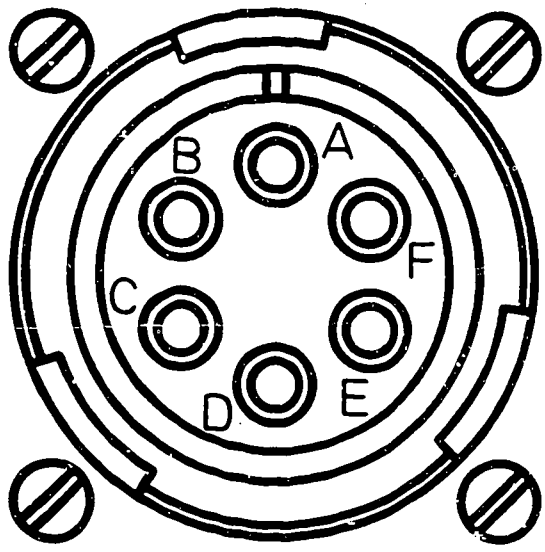


KME 00134

Alternator 0 121 600 514 T2-28V 92/179A
0 121 600 518 T2-28V 92/179A
0 121 600 519 T2-28V 92/179A
0 121 600 520 T2-28V 92/179A

Socket assignment: A = D+
 B = D-
 C = DF1
 D = DF2
 E = D+
 F = B+

Mating plug: Litton Co.
 VG 95234 D-14S-6PN
 VG 95234 E-14S-6PN
 (90 ° offset)



KME 00135

Alternator O 121 600 515 T2-28V 92/179A

Socket assignment:

5-pole
(left picture)

A = B+
B = -
C = B+
D = Phase W
E = -

6-pole
(right picture)

A = D+
B = D-
C = DF1
D = DF2
E = D+
F = B+

Mating plug:

5-pole:

6-pole:

For increased vibration stressing:

5-pole:

6-pole:

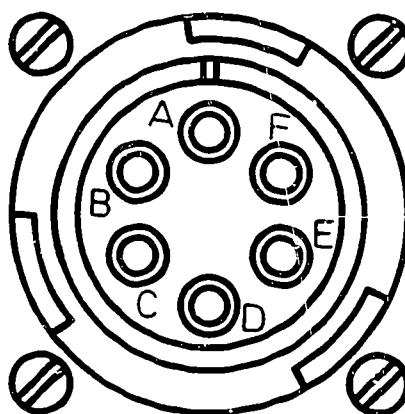
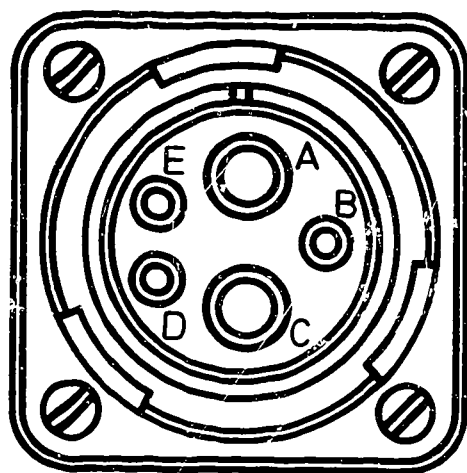
CIR06 F 24-12S-CR

CIR06 F 14S-6P-CR

Litton Co.

VG95234 D24-12SN

VG95234 D14S-6PN



KME 00136

Alternator 0 122 600 001 T3-28V 180A 28

Socket assignment:

A = B+

B = D-

C = DF1

D = DF2

E = Phase UZ - delta connection

F = Phase WY - delta connection

G = Phase VX - delta connection

H = temperature-dependent resistor

J = temperature-dependent resistor

Mating plug: Litton Co. VG 95234

H-20 A9 PN

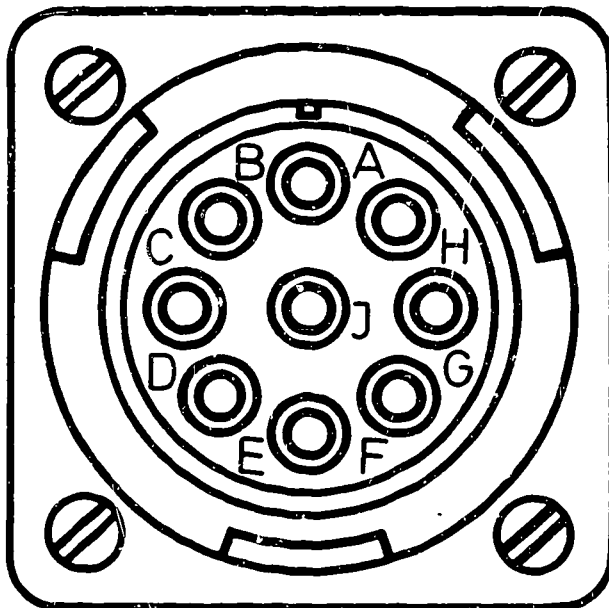
9-pole socket :

A-20 A9 SN,

Corresponding plug:

D, E, G, or

H-20 A9 PN

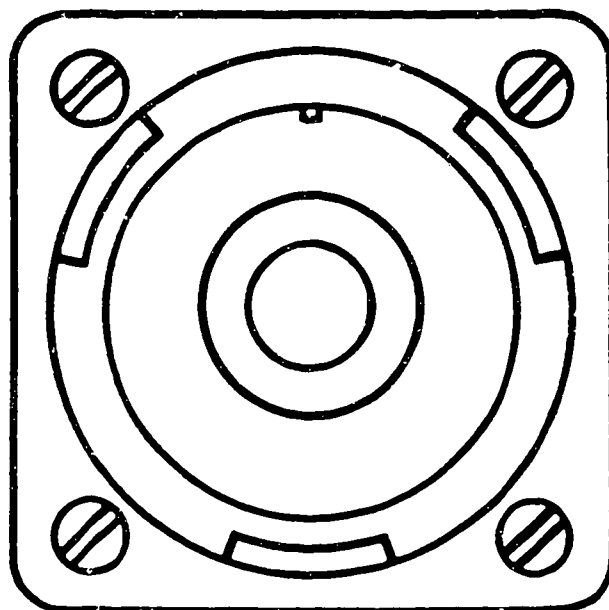


KME 00137

Alternator 0 122 600 001 T3-28V 180A 28
(continued)

1-pole socket: A-20-2 PN (for B+)

Corresponding plug: D, E, G or
H-20-2 SN



KME 00138

* After-Sales-Service Workshops in
Germany:

Addresses of mating-plug manufacturers

Litton Co.:

Veam Elektro-Anschlußtechnik GmbH

Scharnhäuser Straße 3

D-7024 Filderstadt 1

Tel. (0711) 70 20 21/22

Telex 7-255430

Cannon Co.:

CANNON ELEKTRIC GMBH

Postfach 1120

D-7056 Weinstadt

Tel. (07151) 6 80 31

Telex 7-262022

* After-Sales-Service Workshops outside
Germany should consult their
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DATE OF MANUFACTURE FOR
BOSCH PRODUCTS
AS OF 1990

Workshop:
EP, EL, NB
01.1990
0208 En

After 10 years, the monthly code figures for the date of manufacture (MD) of BOSCH products have changed.

The monthly code figures 61 - 72 will be used for the months of January to December in the years 1990 - 1999.

The monthly code figures are preceded by the code figures for the year in the 3-digit date of manufacture (see following list).

The precise dates of manufacture of the defective products are to be indicated on all warranty claims, since they are of great importance for quality check and control.

	1989	1990	1991	1992
January	941	061	161	261
February	942	062	162	262
March	943	063	163	263
April	944	064	164	264
May	945	065	165	265
June	946	066	166	266
July	947	067	167	267
August	948	068	168	268
September	949	069	169	269
October	950	070	170	270
November	951	071	171	271
December	952	072	172	272

	1993	1994	1995	1996
January	361	461	561	661
February	362	462	562	662
March	363	463	563	663
April	364	464	564	664
May	365	465	565	665
June	366	466	566	666
July	367	467	567	667
August	368	468	568	668
September	369	469	569	669
October	370	470	570	670
November	371	471	571	671
December	372	472	572	672

	1997	1998	1999
January	761	861	961
February	762	862	962
March	763	863	963
April	764	864	964
May	765	865	965
June	766	866	966
July	767	867	967
August	768	868	968
September	769	869	969
October	770	870	970
November	771	871	971
December	772	872	972

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OPENING OF
STARTER BATTERIES 0 093..

Workshop: EL
02.1990
0211 En

PbCa starter batteries are completely maintenance-free and should not be opened.

The water consumption is extremely low and the electrolyte is sufficient for the expected lifetime.

Please note that PbCa batteries can generally not be opened without destroying them.

PbCa batteries are therefore only to be opened if the cause of failure has to be diagnosed.

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MODIFICATION TO
DW STARTING MOTORS

Workshop: EL
02.1990
0212 En

For installation reasons,
modifications were made as of model
year 1989 to the drive end shields on
the starting motors 0 001 108 068,
..069, ..070 for Chrysler vehicles.
The starting motors 0 001 108 068,
..069 now feature roller bearings as
a means of increasing power.

Additional tools are to be used for
repairing the starting motors:

for pressing out -the plain bearing:
the press-out mandrel
KDAL 5055,
-the roller bearing:
the press-out mandrel
KDAL 5057

for pressing in -the plain bearing:
the press-in mandrel
KDAL 5056,
-the roller bearing:
the press-in mandrel
KDAL 5058

Note: The bearings cannot be re-used
after being pressed out and are always
to be replaced by new ones.

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REPLACEMENT OF
OVER-VOLTAGE PROTECTION
0 192 900 004
BY FAIL-SAFE PROTECTION
UNIT 0 192 900 007

Workshop: EL
03.1990
0215 En

With its short response time (240...400 microseconds), the over-voltage protection (ÜSG) 0 192 900 004 is suitable for vehicles with voltage-sensitive loads.

The voltage sensitivity of most vehicle electrical systems has been drastically reduced in recent years, so that over-voltage protection with such a brief response time is not always necessary.

Should complaints be received about the over-voltage protection .. 004 on account of frequent response, or should it be defective, we recommend using the fail-safe protection unit 0 192 900 007 (1.0...1.5 millisecond response time).

This reduces the scope of protection.

Operation without battery must be avoided.

If the same scope of protection is demanded, we recommend use of the non-identical, more sophisticated over-voltage protection 0 192 900 008.

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Division KH
Technical After-Sales Service
(KH/VKD 2)

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FOREIGN-LANGUAGE
SERVICE DOCUMENTATION

Workshop:
EP/EL/NB
Motor vehicle:
PKW/NKW/FZD
03.1990
0217 En

Important information for those After-Sales Service Workshops which do not have any service documentation in their native language.

Efficient, worldwide After-Sales Service can only be guaranteed if the appropriate service documentation is available.

There are Bosch After-Sales-Service Workshops in some 120 countries in which 65 different languages are spoken.

Unfortunately we are not in a position to publish such documentation in all these languages, with the result that we must make reference to the following important information.

Numerous testing and repair operations on various products and systems are of relevance to safety. In particular, work on vehicle safety systems (ABS, ETC, EPC and the like) presupposes precise compliance with the system-specific special features which are continuously updated by means of new or supplemented service documentation.

In the event of non-compliance with important information in our instructions on account of language deficiencies, there is a possibility of faults and incorrect settings which may lead to defects and thus to accidents.

In such cases, After-Sales Service Workshops are liable for the resultant damage claims.

For this reason, employees are not to carry out testing and repair operations on products and vehicle systems if they cannot sufficiently familiarize themselves from a technical point of view with the existing service documentation.

An employee with appropriate language and/or system knowledge must be called in to perform the relevant work in such situations.

IF THIS IS NOT POSSIBLE, THE SYSTEM IN QUESTION OR THE UNIT CONCERNED IS NOT TO BE TESTED AND REPAIRED !

To improve this situation, we urgently recommend participation in training courses on the new systems and in corresponding language courses as soon as possible.

All employees are to be made aware of this Service Information. Proof of complete employee information is then to be provided by having them sign to say that they have been made aware of the above.

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After-Sales-Service Department for
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DAMAGE TO STARTING
MOTORS CAUSED BY
PARALLEL RUNNING

Workshop: EL
05.1990
0044 En

Starting-motor series 0 001 1..
0 001 2..
0 001 3..
0 001 42.

1. Typical damage

- Commutator thrown outwards
- Armature winding thrown outwards
- Roller-type overrunning clutch blocked or no longer friction
- locked
- Tarnishing color on roller-type overrunning clutch due to overheating (exception IE and KE with toothed overrunning clutch)
- Pinion bushing worn
- Traces of scoring on armature shaft caused by pinion bushing
- Pinion teeth milled

2. Possible causes

- Fault at solenoid switch, e.g. interturn short circuit in holding winding or pull-in winding or mechanical sticking (foreign body etc.).

Testing of solenoid switch for winding error:

Apply twice rated voltage, in the case of 24 V solenoid switch however max. 36 V, between terminal stud 30 and switch housing. Then push in armature as far as it will go. There is an interturn short circuit in the solenoid switch, if the armature does not properly return to its rest position on being released.

- Permanent or occasional sticking of starting switch.

Possible causes:

Dirt, foreign body, water damage, mechanical damage, manufacturing defect etc.

- Operating error:
Starting motor remains switched on by way of starting switch following start-up of engine.
- Fault in cable (connection between lead 50 and 30 or 50 and 15a).

3. Effects

In all the situations described, the starting-motor pinion remains engaged with the motor ring gear. The following damage sequence is encountered as a function of engine speed and transmission ratio between starting-motor pinion and motor ring gear, as well as on the basis of engagement time:

The grease in the roller-type over-running clutch is over-stressed by the considerable relative movements occurring and thus the excessively high temperatures. The grease thus decomposes (does not apply to KE starting motor with toothed overrunning clutch).

The reduced lubrication capability leads to a further increase in temperature. The overrunning clutch is frequently subjected to thermal overloading to the extent that tarnishing color forms.

Such overloading produces traces of abrasion in the overrunning clutch and causes the rollers to flake; the roller pretensioning springs settle.

The armature speed increases constantly with the overrunning torque of the over-stressed overrunning clutch until the overspeed test speed of the armature is finally exceeded.

Parts of the ejected commutator and/or armature winding block the armature, thus causing the starting-motor pinion/transmission to be pressed out of the motor ring gear via the spiral spline even if the solenoid switch is on.

The pinion teeth rattle past the ring gear; depending on the time sequence, individual teeth of the starting-motor pinion are milled or completely worn down.

Such findings provide clear-cut evidence of the possible faults described.

Reliable proof of excessively long actuation of a solenoid switch is likewise provided by the discoloration of the paper insulation around the holding and pull-in winding. Discoloration only occurs following an uninterrupted ON time of several minutes.

4. Warranty procedure

A warranty claim is only justified if BOSCH parts reveal a manufacturing or material defect.

The most important decision-making criterion is the solenoid-switch test described under item 2.

In the event of a relay fault, the starting motor is to be sent to:

* Service Workshops in West Germany:

ROBERT BOSCH GMBH
Abteilung K9/VAK
Robert-Bosch-Straße

7141 Schwieberdingen

If the solenoid switch is O.K. and the fault is presumed to be in a BOSCH starting switch, you are requested to send the starting switch and starting motor as a case of follow-up damage to:

ROBERT BOSCH GMBH
Abteilung K1/VAK 3
Zweibrückener Straße 13
8500 N ü r n b e r g

In all other cases, warranty claims vis-a-vis BOSCH are not justified.

* Service Workshops outside West Germany should consult their local Bosch representative.

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012 SERIES START-UP
COMPACT ALTERNATORS
0 120 485 ...

Workshop: EL
08.1990
0239 En

Type KC compact alternators
(C = compact) have been manufactured
since December 1989.
Initial deliveries have gone to
Mercedes Benz.

Type NC alternators have since also
gone into production.
The customers for these alternators are
European and Japanese original-
equipment manufacturers.

For quality monitoring purposes, you
are requested to submit defective
compact alternators which are accepted
under warranty along, with the properly
completed warranty claim tag, to the
following address:

* Service Stations in Germany:

Robert Bosch GmbH
Abt. K9/VAK
Robert-Bosch-Str. 4
7141 Schwieberdingen

* Service Stations in all other countries should send the above described alternators to their local Bosch representative for shipment to:

Robert Bosch GmbH
Abt. K9/VAK
D-7000 Stuttgart 30

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service
(KH/VKD 2)

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EV STARTING MOTORS

Workshop: EL

0 001 218 ...

08.1990

0 001 219 ...

0243 En

Conversion of EV starting motors

Conversion of starting motors with plastic internal geared wheel to version with rubber-damped sintered internal geared wheel in planetary gear train.

The EV starting motors 0 001 218 0.. and 0 001 219 0.. with plastic internal geared wheel and encapsulated intermediate shaft are being converted to the further-developed versions 0 001 218 1.. and 0 001 219 0.. (with 24V there was no change of designation to 0 001 219 1..) with rubber-damped sintered internal geared wheel and modified intermediate shaft.

The previous starting motors (with plastic internal geared wheel 9 001 140 322) can be converted when performing repairs to the new versions (rubber-damped sintered internal geared wheel).

The following conversion work is required:

1. Conversion parts sets

The conversion parts sets consist of:

- Planetary gear train complete with intermediate shaft
- Sintered internal geared wheel
- 3 rubber dampers
- Cover disk

For starting motors: 0 001 218 101,

0 001 218 1..

Parts set: 9 002 338 850

Comprising: intermediate bearing, internal geared wheel, rubber damper, tube of grease.

For starting motors: 0 001 218 108
0 001 218 109
0 001 218 110
0 001 219 007

Parts set: 9 002 338 850
9 001 337 056 (with intermediate shaft)

For starting motors: 0 001 218 016
0 001 218 021
0 001 218 029
0 001 219 001

Parts set: 9 001 337 056

For starting 0 001 218 019
motors: 9 000 331 417
Parts set: 9 001 337 057

For starting 0 001 218 014
motors: 0 001 218 022
0 001 218 024
0 001 219 004
Parts set: 9 001 337 058

For starting 0 001 218 004
motors: 0 001 218 005
0 001 218 010
0 001 218 012
0 001 218 013
0 001 218 018
0 001 218 025
Parts set: 9 001 337 059

For starting motors: 9 000 331 421.

Parts set: 9 001 337 060

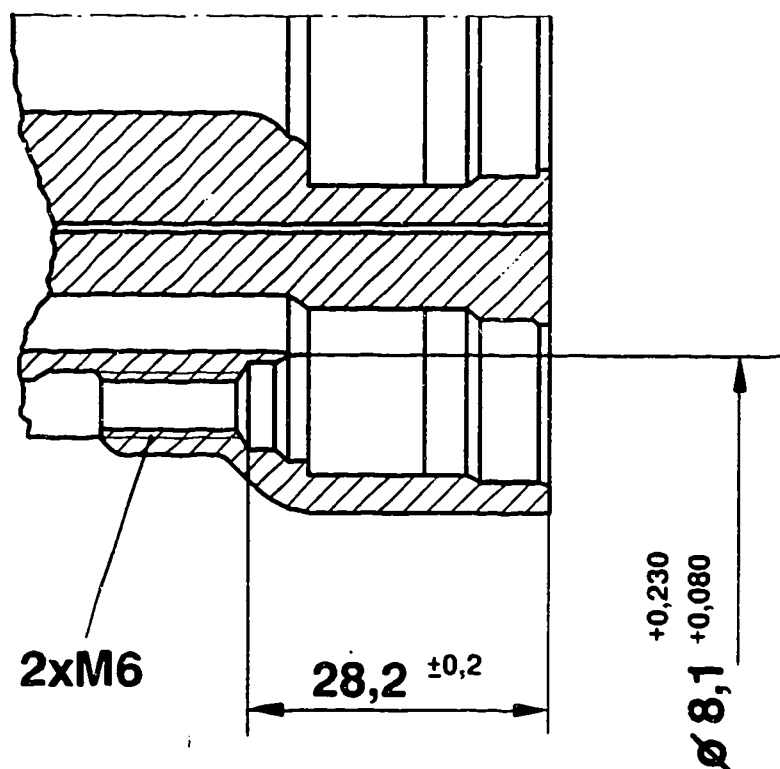
For starting motors: 0 001 219 002,
0 001 219 003.

Parts set: 9 001 337 061

2. Necessary modification to drive end shield

If the conversion parts set is installed in starting motors in which a plastic internal geared wheel had been used, the two M6 holes for the fillister-head screws for holding the heavy-duty spring pins in the intermediate bearing must be re-worked using a suitable twist drill or counterbore as shown in the drawing (see picture).

If, on the other hand, the conversion parts set is installed in starting motors in which a sintered internal geared wheel had already been installed, no re-working is necessary.



KMS00001

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PASTY ARMATURE OR
INTERMEDIATE SHAFT ON
STARTING MOTORS

Workshop: EL
08.1990
0244 En

Pasty armature or intermediate shafts are always the result of external starting-motor contamination (e.g. clutch abrasion, road dirt).
Consequence: meshing rattle.

Starting-motor failure caused by pastiness is therefore not our responsibility and warranty claims can thus not be entertained.

If the armature/intermediate shaft is cleaned, the starting motor can generally be re-used.

To stop the armature becoming pasty again, the clutch housing should be cleaned and the cause of the dirt eliminated (check starting-motor pinion and motor ring gear for damage).

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SERVICING OF
LEAD BATTERIES

Workshop: EL
08.1990
0245 En

Water is decomposed during charging in all lead batteries including ones which are maintenance-free. The electrolyte level drops over the course of time.

PbCa batteries (0 093..) feature an extremely low water consumption level and an electrolyte supply sufficient to cover the expected service life.

With DIN maintenance-free PbSb batteries (0 18. 6.), the electrolyte level must be kept between the two acid-level marks (on outside of housing).

If the acid-level marks cannot be seen on account of unfavourable installation conditions, the electrolyte level is to be checked through the filler openings.

The level may be a maximum of 10 mm above the top edges of the separator and topping up with distilled or demineralized water must be performed if the level has dropped to the top edges of the separator.

The electrolyte level in PbSb batteries should be checked once a year or at more frequent intervals in the case of heavy loading or older batteries.

PbSb batteries (0 18. 0..) are not maintenance-free as defined by DIN.

The maintenance interval must be shorter than in the case of maintenance-free batteries (check approximately every 6 weeks).

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TB, TE, TF
STARTING MOTORS
0 001 600 ... to
0 001 613 ...

Workshop: EL
08.1990
0247 En

New engagement shafts,
pinion attachment with inter-
mediate transmission,
pinning of intermediate bearing

1. Engagement shaft

Up to date of manufacture 821
(Jan. 78), the engagement shafts were
supplied with a locking washer, a
groove in the threaded part and a
pinion fastening nut (Uni-Stop nut).

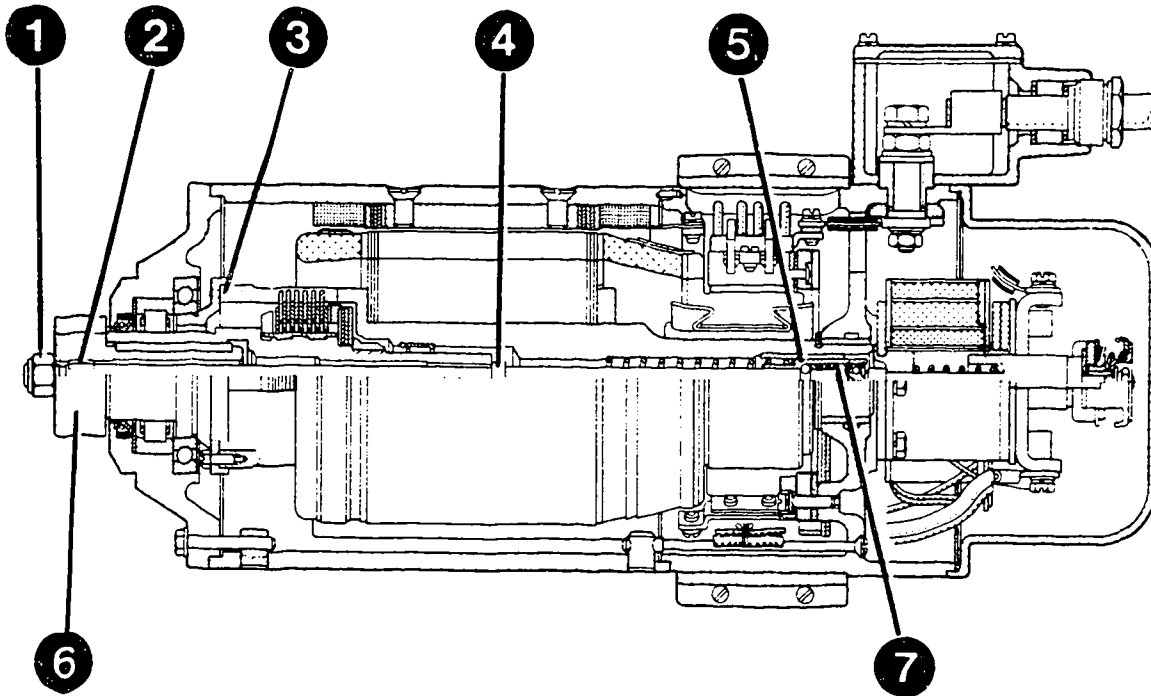
When performing repairs on starting
motors with this engagement shaft, use
is to be made of a new locking washer
1 000 146 001 and the Uni-Stop nut
2 003 315 002 (M 10x1.5) or 2 003 315
000 (M 10x1) depending on the type of
thread.

The following was changed as of date
of manufacture 822 (Feb. 78):

No groove in threaded part.
Instead, there is a 3 mm wide groove
for a rectangular parallel key behind
the threaded part, with this key being
intended to prevent turning with
respect to the pinion. The pinion
features a corresponding groove in the
bore (see picture 1).

Fig. 1

- 1 = As of date of manufacture 926
Uni-Stop nut
- 2 = Rectangular parallel key
- 3 = Pinned intermediate bearing
- 4 = Upset collar on armature shaft
- 5 = Modified armature shaft in
commutator area
- 6 = Pinion
- 7 = Meshing damper spring



KMS 00002

The engagement shaft was provided as a general rule with an M 10x1.5 thread.

Use is now only made for pinion attachment purposes of the Uni-Stop nut 2 003 315 002.

The meshing damper spring was moved from outside to inside the guide sleeve.

When effecting replacement, it is now only possible to supply the complete new engagement shaft as parts set with Uni-Stop nut 2 003 315 002 and rectangular parallel key 1 902 300 021.

Comparison of old and new engagement-shaft parts sets.

Engagement-shaft parts sets	
old	new
2 003 050 001	1 007 010 010
003	011
006	013
019	postponed for the time being
021	015
023	016
1 003 050 008	012

Important: A new pinion is likewise required when repairing an old starting motor with new engagement shaft (modification as of date of manufacture 822).

On the other hand, new pinions (with groove in bore) can also be used for old engagement shafts (with locking washer).

Whenever repairs are carried out, a new Uni-Stop nut is always to be employed and tightened to a tightening torque of 35...45 Nm(3.5...4.5 mkp).

Pinion comparison.

If an old pinion is ordered, a new version is supplied automatically.

Old version	New version
2 006 382 030	1 006 382 130
031	131
034	134
035	135
036	136
037	137
038	138
039	139
041	141
048	148
1 006 382 002	102
003	103
004	104

Table continued:

Old version	New version
2 006 383 030	1 006 383 130
031	131
034	134
035	135
036	136
037	137
038	138
039	139
042	142
043	143

2. Pinion attachment on starting motors
0 001 608... and 0 001 609...
with intermediate transmission

In this case there is no locking washer beneath the fastening screw for the outer pinion. Instead, there is a new pinion fastening screw 2 003 450 001 which features a self-locking Loc-Wel strip (dark coloured strip on thread). Exclusive use is to be made of these new screws when performing repairs. In an emergency, use can still be made of the old type of screw with locking washer.

The positioning hole for the locking washer continues to be located on the pinion end face.

Tightening torque for fastening screw

Old version:

30...40 Nm (3...4 mkp)

New, self-locking version:

40...50 Nm (4...5 mkp)

3. Pinning of intermediate bearing

The intermediate bearing 2 005 857 016 is used for repairing T-type starting motors. The intermediate bearings are supplied with a polished section on the bearing seat and must first be screwed to the armature when performing repairs.

In order to stop the screw connection working loose, the service part (intermediate bearing) is to be additionally pinned with slotted spring pins.

New holes must be drilled for pinning purposes, since the existing holes in the armature cannot be transferred to the intermediate bearing with the required degree of accuracy.

The position of the new holes on the hole circle is arbitrary; they must however be far enough away from the existing holes to ensure that the intervening material thickness is at least 2 mm. The slotted spring pins are contained in the service-parts list and are supplied with the intermediate bearing. The service part (intermediate bearing) is supplied without holes for the slotted spring pins (see Fig. 2).

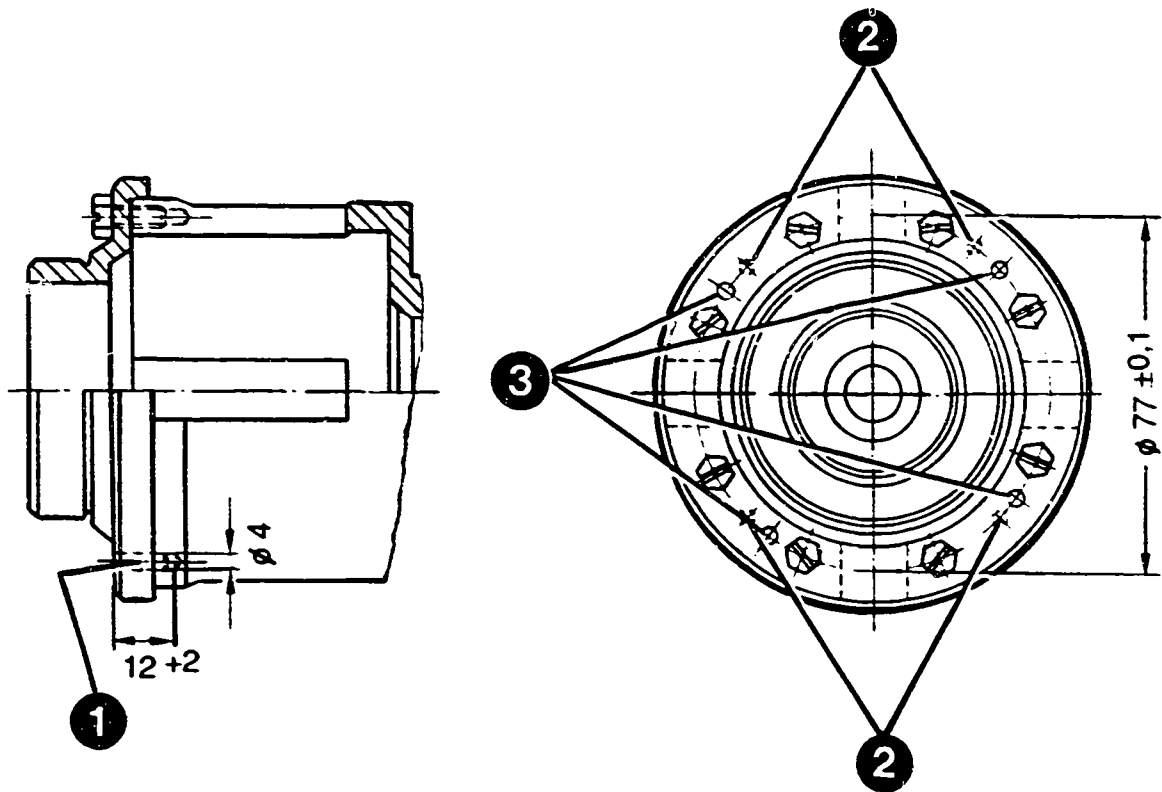
Fig. 2

1 = Slotted spring pin 12 x 4 mm

2 = Position of slotted-spring-pin holes in clutch housing

3 = Possible positions for new holes

Hole-circle diameter = 77 ± 0.1 mm



KMS 00003

Note:

A check is to be made on the permissible eccentricity at the commutator (max. 0.03 mm) and at the laminated core (max. 0.05 mm).

In doing so, pay attention to instructions for "Repairing inertia-drive starting motors" (refer to Index Microcard W-001/00..).

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KT-BATTERIES

Workshop: EL

10.1990

New ampere-hour capacities
and designations

0250 En

To date, the rated capacity of small traction batteries (Kt batteries) has been given on the basis of 20-hour discharge and a discharge current corresponding to 1/20 of the rated capacity.

Example of Kt battery to date 12 V
80 Ah 580 24 (now 956 01):

$$\text{Discharge current} = \frac{80 \text{ Ah}}{20 \text{ h}} = 4 \text{ A}$$

This signifies:
Given 4 A loading, the discharge time for a fully charged battery before reaching a terminal voltage of 10.5 V (battery discharge) will be 20 h. In the long term, this stipulation proved to be far from practical, since the discharge currents typical of Kt batteries are generally higher.

All Kt batteries were thus incorporated into Part 1 of DIN 43 539 which specifies 5-hour discharge with current corresponding to 1/5 of the rated capacity.

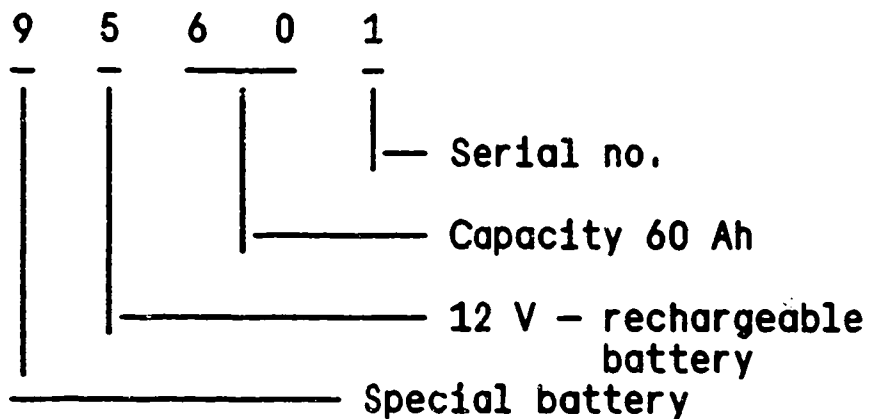
Example of Kt battery 12 V 60 Ah
956 01 (previously 580 24):

$$\text{Discharge current} = \frac{60 \text{ Ah}}{5 \text{ h}} = 12 \text{ A}$$

In view of the fact that batteries do not exhibit linear behavior, the higher discharge current results in a smaller rated capacity although nothing has changed as regards the electrical properties of the rechargeable battery.

The modified Standard has likewise resulted in changes to the structuring of the part no. and in a new designation.

New designation (taking 956 01 as an example):



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IF STARTING MOTORS

Workshop: EL

02.1991

0273 En

0 001 362 700,

0 001 368 077.

Sealing of solenoid-switch
fastening screws

There have been individual instances of starting-motor failure in the field due to the ingress of water at the solenoid-switch fastening screws. This resulted in oxidization of terminal 45 and necessitated replacement of the solenoid switch.

For this reason, we should like to point out that when replacing the solenoid switches

for starting

motor 0 001 362 700 (12 V 2.2 kW)

switch 0 331 402 070

and

for starting

motor 0 001 368 077 (24 V 4.0 kW)

switch 0 331 402 097

approximately 0.5 grams of Loctite 577 (Bosch No.5 994 090 000) is to be applied to the threads of the fastening screws 2 003 429 022 (countersunk screws).

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Starting motors
0 001 416 .. and
0 001 417 ..

Workshop: EL
06.1991
0276 En

Breaking off of pinion teeth

The breaking off of pinion teeth is caused by:

- * Broken-off or severely damaged teeth on motor ring gear
- * Excessive peak-load torque of multi-plate clutch

A check is therefore to be made in the event of pinion-tooth fracture on both the motor ring gear and on the overload protection of the multi-plate clutch (peak-load torque 160 ... 200 Nm). If applicable, the multi-plate clutch is to be adjusted or renewed.

The starting motors are to be repaired free of charge within the warranty period (warranty claim).

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JETRONIC AND
MOTRONIC

Motor vehicle: PKW
and Workshop: EL
06.1991
0278 En

LAMBDA SENSORS

Type overview

Testing

Possible problems with sensor function.
Installation of non-approved sensors.
Vehicle retrofitting for operation
with leaded fuel.

TYPE OVERVIEW, NON-HEATED LAMBDA SENSORS

Designation: LS 4

Features: Lambda = 1 control, 1-pole
Standard protective coating

Fuel : unleaded

Designation: LS 4 t

Features: as LS 4, however
submersible
For extreme water impacting
at installation location.
Recognizable from fine
weld and protection sleeve
next to hexagon.

Designation: LS 4 m

Features: as LS 4, however 2-pole in view of ground cable for sensor signal.

For special requirements as regards signal ground.

Designation: LS 14

Features: as LS 4, however special protective coating for greater resistance to silicon and lead

Designation: LS 21

Features: as LS 4, however new double protective coating for greater resistance to silicon and lead. Also shorter response times.

TYPE OVERVIEW, HEATED LAMBDA SENSORS

Designation: LSH 6

Features: Lambda = 1 control
Standard protective coating

Fuel : unleaded

Designation: LSH 15

Features: Lambda = 1 control
Sintered-in protective coating

Fuel : unleaded

Designation: LSH 22

Features: Lambda = 1 control
Sintered-in protective coating
Ground wire for Lambda-Signal

Fuel : unleaded

Designation: LSH 24

Features: Lambda = 1 control
Double protective coating
and greater silicon resistance

Fuel : unleaded

Designation: LSH 25

Features: Lambda = 1 control
Double protective coating
and increased silicon resistance

Fuel : unleaded

Designation: LSH 23

Features: Lambda = 1 control
Resistance to lead

Fuel : unleaded

Designation: LSM 11

Features: Lambda = 1 control as well
as lean and rich evaluation
Resistant to lead

Fuel : leaded

DESIGN VARIANTS

Standard: Heater 12 W

Protective conduit with 3
slots
3 electrical connections

Designation p: Heater 13 W

Quicker switch-on of
Lambda control.
Heating must be switched
off as of 800° C.

- Designation h: Protective conduit made of Inconel. Exhaust gas up to 1000° C permitted for brief periods.
- Designation l: Protective conduit, 1 hole and 4 flaps. Greater protection against deposits. Damping of Lambda voltage signal.
- Designation m: Additional ground lead for sensor signal.
- Designation t: Submersible for extreme water impacting in the case of underfloor installation position. Recognizable from fine weld around protection sleeve next to hexagon.

GENERAL

Electrical connections:

Lead color	Function
Black	Sensor signal, positive
Gray or housing	Sensor signal, negative
White, 2 leads	Heating positive / negative

Installation instructions:

- * Apply small quantity of assembly paste VS 14016 FT to thread; 120 g tin, part no. 5 964 080 112.
- * Tightening torque: 50...60 Nm
- * Do not spray connector - in particular connector of submersible sensor - with contact spray. This clogs "breather hole" and prevents proper functioning of sensor.

TESTING

The lambda sensor is to be tested with the engine running and at operating temperature using the lambda closed-loop control tester ETT 018.10, part no. 0 684 101 810.

Connection to the vehicle is described in the operating instructions for the tester.

Any lambda sensor can be connected up by way of a vehicle-specific multiple adapter lead. The part numbers for the adapter leads are given in the Service Info "Lambda closed-loop control tester". Refer to microcard SIS KFZ-00. motor vehicle:pass. car/comm. veh.

Test specifications

Sensor heater (white leads)

With engine stopped

* Resistance (PTC): 1...15 ohms

With engine running

* Supply voltage : 8...15 V

* Heating current : > 0.5 A

Sensor signal (black lead = positive, ground = housing or gray lead).

* Resistance at approx. 350° C: < 8 kohms

* Sensor voltage with

Lambda = 0.97 (CO approx. 1%):

> 650 mV

Lambda = 1.10: -100...+80 mV

* Response time with voltage step

change 300...600 / 600...300 mV:

< 500 ms

Notes

Functional control can be assumed in the fuel injection system if the measured actual values are within the test-specification tolerance.

In view of the fact that the exhaust-gas values of a vehicle are also highly dependent on the other system components (engine, catalytic converter, installation position and closed-loop control), these values do not make it possible to draw reliable conclusions as to the emission behaviour.

Test instructions

Further important aspects as regards trouble-shooting on lambda closed-loop control.

- * Check control-unit sensor input.
S e p a r a t e sensor plug connection.
Measure lambda countervoltage (from control unit) at idle with digital multimeter : 450...550 mV.
- * Lambda sensors with no gray lead are provided with engine ground by way of exhaust manifold and exhaust pipe. Loose connections or increasing exhaust-system age can result in driving problems on account of the ground offset becoming larger.
- * Even minor leaks in the exhaust system between engine and lambda sensor cause rough engine running.

POSSIBLE PROBLEMS WITH SENSOR FUNCTION

External influences:

- * Damage caused by flying stones.
- * Damage to connecting leads at kinked areas/abraded areas as well as damage caused by the heat of the exhaust pipe.
Applies only to "non-submersible" sensors:
- * Short-term electrical malfunction caused by ingress of splashwater at "breather hole". This problem generally disappears after engine has been running for a few minutes as a result of evaporation.
- * The sensor must be covered if under-body sealant is applied. Clogging of the "breather hole" results in permanent damage and rough engine running.

Internal influences:

The functioning of the sensor is impaired by various types of "foreign matter" in the exhaust gas. This can result in total failure depending on degree of contamination and type of sensor.

"Foreign matter":

- * Coolant containing antifreeze
- * Engine oils, in particular synthetic oils
- * Non-combustible additives in fuel
- * Leaded fuel
- * Silicon compounds in fuel tank or in fuel lines.

Normal amounts of coolant and engine oil are not harmful.

Thermo-shock fractures of the active ceramic can be caused by exhaust-gas condensate.

INSTALLATION OF NON-APPROVED SENSORS

There is often a desire or the need to fit a sensor with a wider range of features instead of the standard sensor installed by the vehicle manufacturer.

Examples of desired alternative lambda sensors.

Instead of series sensor Alternative sensor?

Non-heated

Heated

Standard

Submersible

Standard

Lead-resistant

Standard

Silicon-resistant

Conversion is not generally permitted!

Lambda sensors are approved by the vehicle manufacturer for individual vehicles.

Officially, the vehicle is not licensed if sensors are fitted which differ from the type approval.

If problems are encountered in individual cases with the series sensor, for example, if water has ingressed or in the case of temporary operation with leaded fuel, customers are to be referred to the vehicle manufacturer's representative.

For example, lead-resistant sensors have been released for various export models.

VEHICLE RETROFITTING

The instructions given by the vehicle manufacturer are always to be followed if a vehicle with regulated catalytic converter is to be retrofitted for operation with leaded fuel.

Catalytic converter and lambda sensor are normally removed to stop them becoming clogged by lead compounds. An appropriate exhaust pipe is fitted in place of the catalytic converter and usually a plug instead of the lambda sensor. The open wiring-harness plug remains unused and is not to be connected either to positive or negative. The engine runs on an open loop-controlled mixture.

Any further measures which may be required such as recoding or circuit changes are always to be performed on the basis of the instructions given by the vehicle manufacturer.

Note:

If vehicles feature self-diagnosis, then this is likewise affected by removal of the lambda sensor.

I M P O R T A N T

Following retrofitting, it is to be expressly pointed out to customers that the log book is to be altered accordingly by the licensing authorities. If this alteration is not made, the vehicle is no longer licensed and drivers may face charges of tax evasion.

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EXPLOSIONPROOF
MAGNETOS
MZ 4/4..., MZ/JGP and
GP (0 203 308 ...)

Workshop: EL
02.1992
0310 En

The above-listed explosionproof
magnetos are no longer being
manufactured

Where possible, service parts for
these magnetos can only be supplied
by

RUOSS Feinmechanik Werkzeugbau
Inh. E. Fetzner
Postfach 1105
7917 Vöhringen
GERMANY

Tel.: 07306/ 6312 (Fax 3 22 77)

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UNIVERSAL MEASUREMENT
STATION LOCATIONS
IN GERMANY

Workshop: EL
08.1992
0054 En

BOSCH WHOLESALERS

Location	BG (BE/VH)
Aachen	Schmitz
Albstadt 1	Lorch
Aschaffenburg	Wissel
Bayreuth 2	Knoll
Berlin 12	Verkaufshaus Berlin BE/VT5
Bielefeld 1	Kalveram
Bonn	Hüller & Brunn
Bremen 45	HASECO
Darmstadt	Kickler & Co
Dortmund	Strobl
Düsseldorf 1	Boss
Essen 1	Soeffing
Freiburg / Br.	Wagener & Schade
Gießen	Keller&Schneider
Hamburg 26	Fetzer
Hannover	Kruse
Kassel-Waldau	Maurer
Koblenz	Wagener
Lübeck	Scherer
Mannheim	Schöberl Lübeck
München 45	Blickle
	Meinburk Meineke

Münster/Westf.	Coler
Neuötting	Leitl
Neu-Ulm	Dürr
Nürnberg 10	Koller&Schwemmer
Regensburg	Küblbeck
Reutlingen	Gokenbach
Schweinfurt	Mezger & Schlag
Straubing	Pregler
Stuttgart 60	Trost
Trier	Weiler
Weiden (Zweigbetrieb von Regensburg)	Küblbeck

BOSCH SERVICE STATIONS

Location	BD
Aichelberg	Straub
Augsburg	Dürr
Bad Neustadt / S.	Endrich
Bad Säckingen	Weber
Bamberg	Engert
Bocholt	Degeling
Bochum	Boesner
Breklum	Hörcher
Dortmund	Völkman
Ehingen	Radi
Flensburg	Stegner&Grundner
Frankfurt/M. 90	Schmitt
Hamburg 90	Zöger

Haßfurt
Heilbronn
Helmstedt
Ingolstadt
Iserlohn
Kaiserslautern
Kaiserslautern
Karlsruhe 21
Lage
Kiel 14
Köln 30
Landshut / Bayern
Lebach
Lohne
Ludwigsburg
Lüdenscheid
Maxdorf

Betz
Dieterich
Ranft
Miller
Wessalowski
Henn
Müller
Blickle
Büker
Droege
Neuerburg
Käufel
Weber
Südbeck
Sulzberger
Schöneborn
Wiebelskircher

Neuwied
Nuremberg
Oberkotzau
Oldenburg / Old.
Osnabrück
Osnabrück
Passau
Remscheid
Rheine / Westf.
Rheinfelden
Rottweil-Altstadt
Saarbrücken 3
Siegen 1
Stuttgart 80
Trier
Ulm

Vogtmann-Herold
Schmidt
Böhringer
Kickler
Hartlage
Haug
Müller
Klaiss
Klaps
Niethammer
Müller
Lichius
Römer
Gebert
Dorner & Volbach
Mack

Wiesbaden-Biebrich
Wuppertal
Würzburg

Schäufele
Hauptmann
Mezger & Schlag

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SELF-DIAGNOSIS

Motor vehicle: PKW
and workshop: EL

MONO-JETRONIC

08.1992

MONO-MOTRONIC

0346 En

The self-diagnosis can be activated and the fault memory read out either with engine ON or with engine idling.
Motorleerlauf erfolgen.

Note:

With ignition ON and self-diagnosis activated, fault code "No engine speed signal"/"No Hall trigger signal" is always activated.

This is OK since no engine speed pulses are being applied. There is thus no fault, but rather the current status is indicated as information.

If the same fault code is indicated with engine idling/after 6s starting, then there really is a defect in the ignition system or leads.

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**INSTALLATION
INSTRUCTIONS
PLUG ASSIGNMENT FOR
13-POLE PLUG/SOCKET**

**Workshop: EL
10.1992
0353 En**

**13-pole plug DIN 72 570, socket
and parking socket.**

**Assignment of contacts 1...7, identical
to 7-pole plug DIN 72 577
(ISO 1724).**

ISO 1724	DIN 72 577	
Contact no.	Wire color	Contact designation
1	yellow	L
2	blue	54g
3	white	31
4	green	R
5	brown	58R
6	red	54
7	black	58L

Assignment of contacts 1...13

Contact no.	Circuit
1	Direction indicator, left
2	Fog warning lamp
3	Ground for circuit contacts 1...8
4	Direction indicator, right

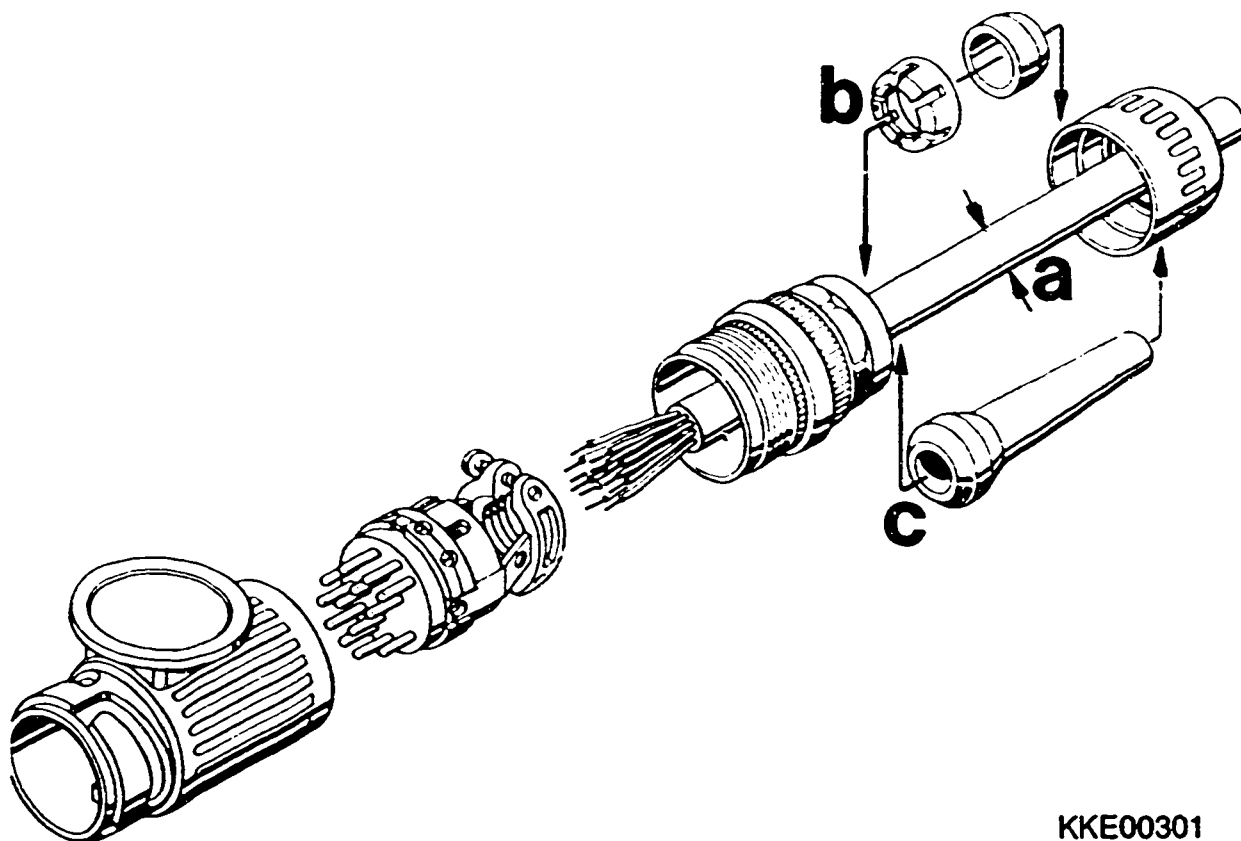
Contact no.	Circuit
5	Right-hand tail lamp, clearance lamp, side-marker lamp, license-plate lamp
6	Stop lamps
7	Left-hand tail lamp, clearance lamp, side-marker lamp, license-plate lamp
8	Backup lamp and/or backup unit for over-run braking system

Contact no.	Circuit
9	Power supply (continuous positive)
10	Positive charging lead for battery in trailer
11	not assigned
12	not assigned
13	Ground for circuit contacts 9...12

PLUG ASSEMBLY

The picture below illustrates plug assembly.

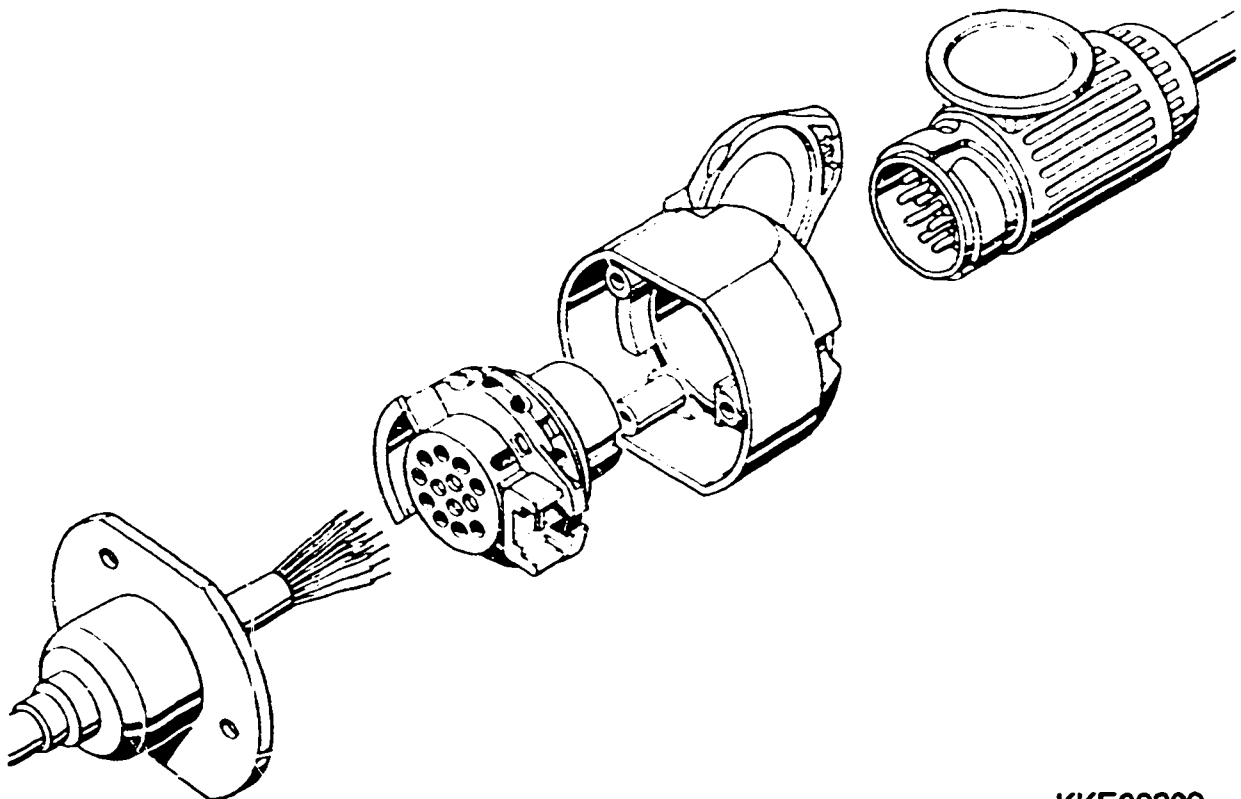
b for lead a max. 17 mm diameter
c for lead a max. 12 mm diameter



KKE00301

SOCKET ASSEMBLY

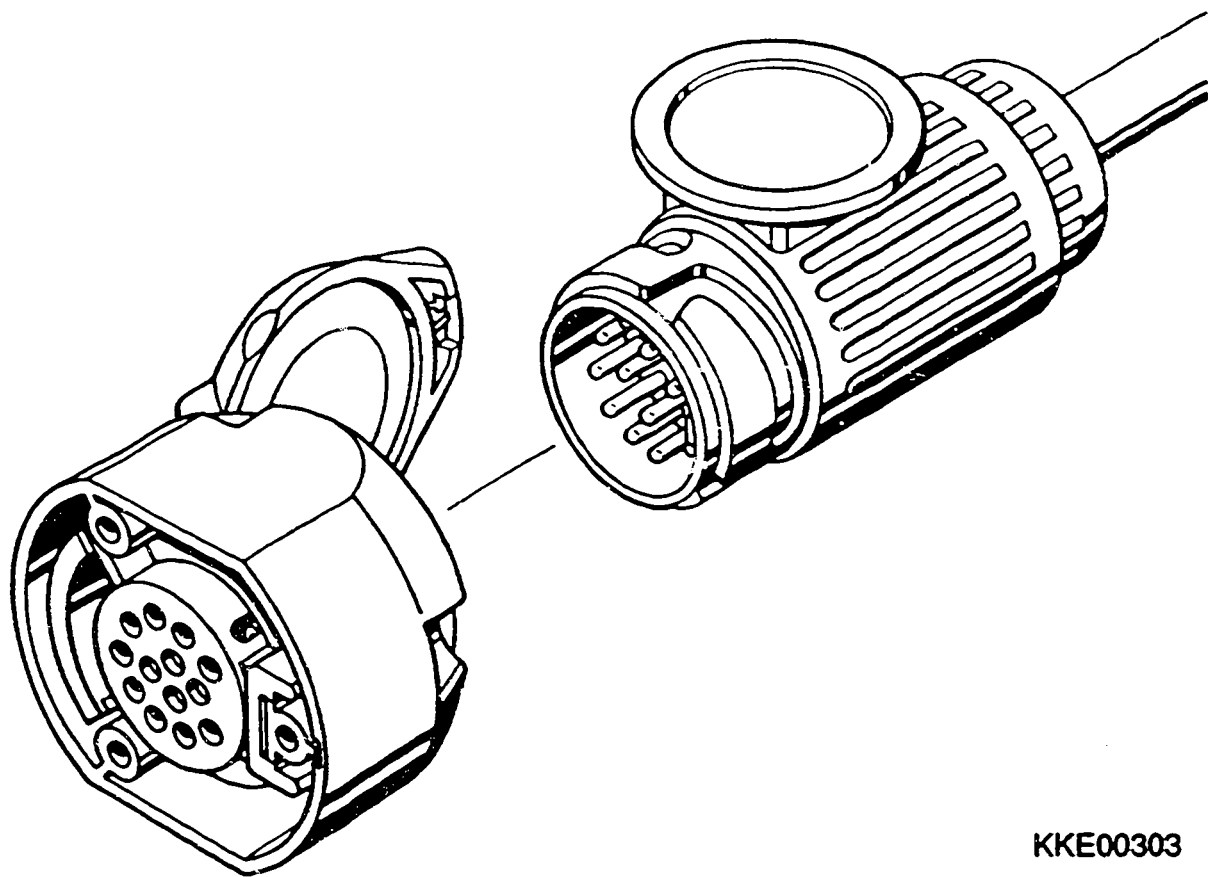
The picture below illustrates socket assembly.



KKE00302

PARKING SOCKET CONNECTION

The picture below illustrates parking socket connection.



KKE00303

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Robert Bosch GmbH
Division KH
After-Sales-Service Department for
Training and Technology (KH/VSK)

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012 THREE-PHASE
ALTERNATORS
WITH ZENER DIODES
(Z-DIODES) IN CONJUNCTION
WITH OVER-VOLTAGE PROTECTION DEVICE
(ÜSG) OR CONSEQUENTIAL-DAMAGE
PROTECTION DEVICE (FSG)

Workshop: EL
06.1993
0361 En

Three-phase alternators with Z-diodes are not to be used in connection with over-voltage or consequential-damage protection devices (exception T1 28V 180A with special FSG 0 192 900 009).

If the alternator on a vehicle with ÜSG or FSG is replaced by an alternator with Z-diodes or if a rectifier with Z-diodes is fitted as service part, the protective function is assumed by the Z-diodes.

The old ÜSG/FSG must then be removed. It can no longer provide a protective function for alternators with Z-diodes and is no longer permissible for reasons of product liability.

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QUICK
LOCATION OF NEW
SERVICE INFO
ON MICROCARDS

003.93 En
09.1993

Service Info has been exclusively published on microcards since mid-1991. There is no longer a hard copy.

We are often asked where the latest Service Info is to be found, and on which microcards.

The latest Service Info always comes at the end of a given microcard so as to make for a rapid overview of the most important new features as required.

Microcards featuring Service Info are marked with an * on the record list.

Listed in the following for your reference are the current Service Info microcards which will be distributed as and where necessary:

Assembly shops

1. FZG-001 Information from and for Bosch Service Stations
2. FZD-025 Passenger and commercial-vehicle info (Diesel only)
3. KFZ-015 Info concerning both passenger and commercial vehicles (not brakes and Diesel)
4. PKB-026 Brake-system info incl. ABS for passenger and commercial vehicles
5. NKW-008 Info exclusively for commercial vehicles (not brakes and Diesel)

Assembly shops

6. PKW- 160 Info exclusively for passenger vehicles (not brakes and Diesel)
7. PKW-5001 Info exclusively for passenger vehicles with mixed and non-Bosch systems (not brakes and Diesel)

Repair shops

8. W-001/020 EL workshop info
9. W-400/040 EP workshop info
10. W-480/005 NB workshop info

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KB-STARTING MOTOR
0 001 417 045/047
FOR SCANIA ENGINES DTC11

Mot. veh.: NKW
Workshop: EL
09.1993
0376 En

Modified installation position

SCANIA vehicles DTC11 (Turbo-compound) now feature a modified starting motor installation location. As a result, the terminals face perpendicularly downwards and carbon brush abrasion may be deposited between terminal 30 and ground. A short circuit between terminal 30 and ground can lead to burnout of the insulation.

Where this problem is encountered on vehicles with DTC11 engine already in use, the starting motors are being converted by SCANIA with the aid of a conversion kit (insulating foil, insulated connection 30 with shrink-down tubing).

November 1992 saw the series introduction of the starting motor 0 001 417 045/047 with powder-coated terminal bar.

Should starting motors
0 001 417 045/047 with production date
FD 271 or older with non-insulated
terminal bar nevertheless be
encountered, it must always be ensured
that they are converted in line with
the current service parts list
(connection 30 with insulated terminal
bar).

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